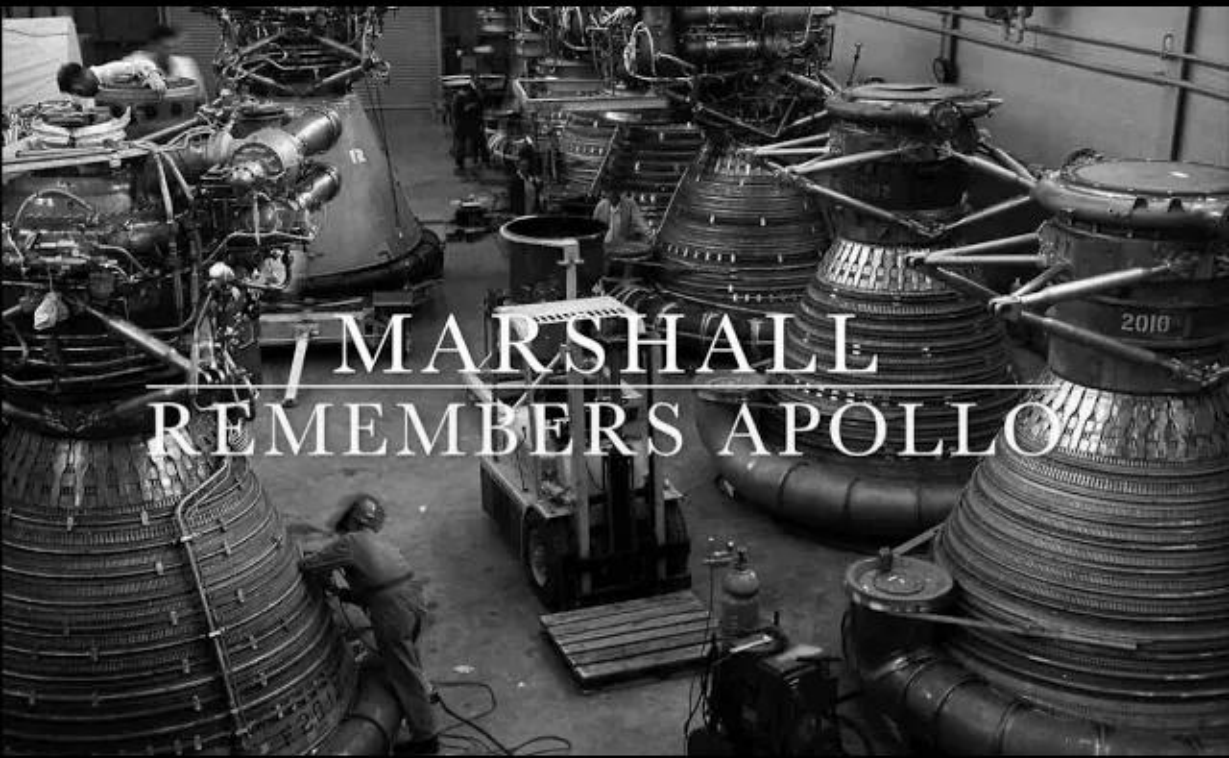
MARSHALL
REMEMBERS APOLLO

1
00:00:01,130 --> 00:00:16,200
[Music]

2
00:00:23,590 --> 00:00:20,440
well I finished Clemson College in 1951

3
00:00:25,210 --> 00:00:23,600
and it was second lieutenant of all

4
00:00:27,940 --> 00:00:25,220
certain went immediately in the airforce

5
00:00:30,190 --> 00:00:27,950
stayed in the Air Force for 21 months to

6
00:00:33,310 --> 00:00:30,200
meet my obligations got out of the Air

7
00:00:35,200 --> 00:00:33,320
Force and stayed in reserve and then I

8
00:00:37,300 --> 00:00:35,210
decided to go back school to try to see

9
00:00:39,490 --> 00:00:37,310
if I get my master's degree I started my

10
00:00:41,260 --> 00:00:39,500
master's degree work and couldn't find a

11
00:00:44,080 --> 00:00:41,270
good topic so I decided to go to work

12
00:00:45,940 --> 00:00:44,090
and went on down to Eglin Air Force Base

13
00:00:47,650 --> 00:00:45,950

in Florida worked for bitch'll

14
00:00:49,990 --> 00:00:47,660
Corporation of America for about three

15
00:00:51,790 --> 00:00:50,000
months there then later on went back to

16
00:00:55,840 --> 00:00:51,800
grad school again came back to Eglin

17
00:00:58,930 --> 00:00:55,850
again and that wasn't since June of 1956

18
00:01:01,299 --> 00:00:58,940
and as a weapons test engineer my job

19
00:01:03,459 --> 00:01:01,309
there was to try to look at the

20
00:01:06,190 --> 00:01:03,469
accessibility of weapons systems on

21
00:01:08,200 --> 00:01:06,200
aircraft and then I heard about the ABM

22
00:01:09,850 --> 00:01:08,210
a operation coming up here in Huntsville

23
00:01:11,860 --> 00:01:09,860
Alabama so I just thought I'd come up

24
00:01:14,140 --> 00:01:11,870
here and apply for a job but being a

25
00:01:16,240 --> 00:01:14,150
civil being a civil service employee I

26
00:01:19,899 --> 00:01:16,250
just transferred up here so I came up

27
00:01:22,990 --> 00:01:19,909
here in October 1956 and my first job

28
00:01:25,660 --> 00:01:23,000
was with my boss was Hans Paul one of

29
00:01:27,460 --> 00:01:25,670
the German pin a Monday group and Hans

30
00:01:29,469 --> 00:01:27,470
was a very good boss for me and he was

31
00:01:31,120 --> 00:01:29,479
he matter of fact that I hadn't knew I

32
00:01:33,670 --> 00:01:31,130
was working on my master's degree so he

33
00:01:36,969 --> 00:01:33,680
asked me to work on some cooling system

34
00:01:39,160 --> 00:01:36,979
designs and I did that and then I did a

35
00:01:40,510 --> 00:01:39,170
lot of work in flight evaluation also

36
00:01:42,730 --> 00:01:40,520
trying to figure out what happened the

37
00:01:45,670 --> 00:01:42,740
vehicles when they flew over a period of

38
00:01:47,800 --> 00:01:45,680

time I was able to work a deal with Hans

39
00:01:49,630 --> 00:01:47,810
that I could go back to grad school so

40
00:01:51,580 --> 00:01:49,640
he sent me back to grad school and I did

41
00:01:54,609 --> 00:01:51,590
my thesis on boiling of liquid nitrogen

42
00:01:57,069 --> 00:01:54,619
and that was used in the coolant system

43
00:01:59,260 --> 00:01:57,079
on the Jupiter system so from the

44
00:02:01,450 --> 00:01:59,270
cooling system design I wound up like I

45
00:02:03,249 --> 00:02:01,460
said doing a lot of evaluation of

46
00:02:06,789 --> 00:02:03,259
missile flight test on a redstone on

47
00:02:09,969 --> 00:02:06,799
Jupiter Juno general one didn't get to

48
00:02:12,760 --> 00:02:09,979
work on the Saturn one at all but they

49
00:02:16,720 --> 00:02:12,770
developed systems analysis ninna became

50
00:02:18,790 --> 00:02:16,730
a aerodynamic so research engineer which

51
00:02:20,710 --> 00:02:18,800
were doing aerodynamic heating studies

52
00:02:22,690 --> 00:02:20,720
imagine the temperatures of the various

53
00:02:26,220 --> 00:02:22,700
parts of the vehicle and while during

54
00:02:27,790 --> 00:02:26,230
flight and then later on night that was

55
00:02:32,290 --> 00:02:27,800
1960

56
00:02:34,780 --> 00:02:32,300
as I remember transferred in the

57
00:02:36,280 --> 00:02:34,790
Marshall Space Flight Center and I was

58
00:02:38,920 --> 00:02:36,290
immediately transferred into the air

59
00:02:41,290 --> 00:02:38,930
ballistics division there and I was in

60
00:02:44,020 --> 00:02:41,300
the technical and scientific staff on

61
00:02:44,440 --> 00:02:44,030
the air ballistics division at Marshall

62
00:02:46,780 --> 00:02:44,450
here

63
00:02:49,510 --> 00:02:46,790

and then over a period of time in that

64
00:02:52,060 --> 00:02:49,520
job I wound up being a project engineer

65
00:02:54,820 --> 00:02:52,070
only Atlas Center and the Atlas Aegina

66
00:02:57,400 --> 00:02:54,830
and that program however was transferred

67
00:02:59,950 --> 00:02:57,410
out at a paired time to Lewis Research

68
00:03:01,660 --> 00:02:59,960
Center and so I did not want to go to

69
00:03:03,850 --> 00:03:01,670
Lewis Research Center so I came back to

70
00:03:09,339 --> 00:03:03,860
Marshall and went back to my work in the

71
00:03:13,780 --> 00:03:12,369
when I first got here in 56 of a friend

72
00:03:16,929 --> 00:03:13,790
of mine both of us came up from Florida

73
00:03:18,849 --> 00:03:16,939
and we decided we would maybe we'll go

74
00:03:20,229 --> 00:03:18,859
to work for ABM a but we actually want

75
00:03:22,300 --> 00:03:20,239
to tell a homeowner to see what they

76
00:03:25,229 --> 00:03:22,310
were doing up there and we came back to

77
00:03:27,240 --> 00:03:25,239
ABM a but the problem in Huntsville 1956

78
00:03:29,770 --> 00:03:27,250
population was somewhere around I think

79
00:03:32,530 --> 00:03:29,780
47,000 or something like that and there

80
00:03:34,479 --> 00:03:32,540
were no places to stay so all five of us

81
00:03:37,270 --> 00:03:34,489
guys got together and rented the ladies

82
00:03:39,640 --> 00:03:37,280
living room for a few months until we

83
00:03:41,259 --> 00:03:39,650
could find a house one of our guys

84
00:03:43,479 --> 00:03:41,269
actually built a duplex and the

85
00:03:46,089 --> 00:03:43,489
restaurant moved in with him and I moved

86
00:03:47,770 --> 00:03:46,099
into a separate place myself and that's

87
00:03:50,349 --> 00:03:47,780
all the way it was in Huntsville it was

88
00:03:52,809 --> 00:03:50,359

just a laid-back town it was just like

89
00:03:54,369 --> 00:03:52,819
it was it you know Redstone Arsenal was

90
00:03:58,300 --> 00:03:54,379
bringing money it was like we always

91
00:04:00,879 --> 00:03:58,310
said it was a center of poverty an inner

92
00:04:02,949 --> 00:04:00,889
service center of prosperity because the

93
00:04:05,379 --> 00:04:02,959
fact that cotton fields here we're not

94
00:04:06,789 --> 00:04:05,389
selling their cotton and they and there

95
00:04:09,670 --> 00:04:06,799
was no interest in the area and so

96
00:04:11,559 --> 00:04:09,680
Sparkman senator Sparkman really was a

97
00:04:13,030 --> 00:04:11,569
trigger that put Redstone Arsenal on the

98
00:04:14,800 --> 00:04:13,040
map and he got a member now the average

99
00:04:17,080 --> 00:04:14,810
age for the engineer as well as I

100
00:04:19,180 --> 00:04:17,090
understand was 24 to 27

101
00:04:22,120 --> 00:04:19,190
most of us were just out of college

102
00:04:23,680 --> 00:04:22,130
didn't have a bunch of experience but

103
00:04:25,089 --> 00:04:23,690
here's what challenge we're gonna do

104
00:04:27,550 --> 00:04:25,099
something in 10 months has never been

105
00:04:28,930 --> 00:04:27,560
done before and so that was the thing

106
00:04:31,029 --> 00:04:28,940
about it was so interesting to be

107
00:04:33,430 --> 00:04:31,039
working in these challenging situations

108
00:04:35,290 --> 00:04:33,440
we didn't mind working 80 bucks 80 hours

109
00:04:37,270 --> 00:04:35,300
a week because when you were going to do

110
00:04:38,950 --> 00:04:37,280
something different and that was part of

111
00:04:40,540 --> 00:04:38,960
everybody had so much enthusiasm about

112
00:04:41,920 --> 00:04:40,550
it that that was the thing about von

113
00:04:45,700 --> 00:04:41,930

Braun he created so much enthusiasm

114
00:04:51,970 --> 00:04:45,710
about let's get this job done and do be

115
00:04:59,950 --> 00:04:56,830
I wound up being of men for the

116
00:05:03,400 --> 00:04:59,960
operations of developing design criteria

117
00:05:05,140 --> 00:05:03,410
for the lunar rover and so knowing

118
00:05:07,270 --> 00:05:05,150
nothing about the moon I begin to have

119
00:05:09,070 --> 00:05:07,280
to study a lot about the moon's surface

120
00:05:10,750 --> 00:05:09,080
what I thought it might be like and

121
00:05:13,060 --> 00:05:10,760
talked to the geologists to try to get

122
00:05:15,280 --> 00:05:13,070
some good feeling and then were able to

123
00:05:17,410 --> 00:05:15,290
get the surveyor spacecraft to land on

124
00:05:19,060 --> 00:05:17,420
the moon and so we landed several of

125
00:05:20,530 --> 00:05:19,070
those spacecraft on the moon and they

126
00:05:22,630 --> 00:05:20,540
gave us a good idea of the soil

127
00:05:24,700 --> 00:05:22,640
characteristics as well as a debris

128
00:05:26,770 --> 00:05:24,710
around the landing sites and we actually

129
00:05:28,570 --> 00:05:26,780
had one severe that bounced a couple of

130
00:05:31,530 --> 00:05:28,580
times which gave us a good idea of the

131
00:05:34,270 --> 00:05:31,540
lunar surface operations then later on

132
00:05:37,060 --> 00:05:34,280
we got the orbiter program and the

133
00:05:38,950 --> 00:05:37,070
orbiter program was an orbiting about 70

134
00:05:41,290 --> 00:05:38,960
miles 50 to 70 miles I'll think about

135
00:05:43,390 --> 00:05:41,300
the surface of moon and it gave us one

136
00:05:46,870 --> 00:05:43,400
meter resolution about three foot

137
00:05:48,580 --> 00:05:46,880
resolution roughly of the crater size is

138
00:05:50,650 --> 00:05:48,590

the number of craters or rocks around

139
00:05:53,200 --> 00:05:50,660
the crater thing like that so that was

140
00:05:56,110 --> 00:05:53,210
very useful for us as a design criteria

141
00:05:58,330 --> 00:05:56,120
point and then we can later on decided

142
00:06:00,130 --> 00:05:58,340
well we know pretty much about what the

143
00:06:02,410 --> 00:06:00,140
surface characteristics are like because

144
00:06:04,960 --> 00:06:02,420
of the severe spacecrafts so we'll

145
00:06:07,660 --> 00:06:04,970
develop some lunar simulated materials

146
00:06:09,820 --> 00:06:07,670
that we think would be a characteristics

147
00:06:11,950 --> 00:06:09,830
on the lunar surface operations and if

148
00:06:14,380 --> 00:06:11,960
we get in the future to do some lunar

149
00:06:17,710 --> 00:06:14,390
mobility studies we'll continue maybe

150
00:06:20,740 --> 00:06:17,720
use that simulant as a device for the

151
00:06:22,600 --> 00:06:20,750
wheel design and so that's actually what

152
00:06:24,430 --> 00:06:22,610
happened the lunar surface materials

153
00:06:26,500 --> 00:06:24,440
were created because we knew the

154
00:06:29,110 --> 00:06:26,510
particle size roughly the particle sizes

155
00:06:30,970 --> 00:06:29,120
things that sort and so we use that the

156
00:06:34,090 --> 00:06:30,980
waterways Experiment Station down in

157
00:06:36,540 --> 00:06:34,100
Mississippi had all these of test bins

158
00:06:41,110 --> 00:06:36,550
and we had these big test bins full of a

159
00:06:43,000 --> 00:06:41,120
lunar soil simulate and dr. Costas was

160
00:06:47,260 --> 00:06:43,010
when I worked with two he also was a

161
00:06:49,990 --> 00:06:47,270
Soyuz expect expert and so he and I

162
00:06:51,910 --> 00:06:50,000
together we were authorized to form a

163
00:06:54,370 --> 00:06:51,920

panel called a lunar surface travel

164
00:06:57,160 --> 00:06:54,380
ability panel and I was co-chairman of

165
00:06:58,840 --> 00:06:57,170
that and from that data we we actually

166
00:07:01,480 --> 00:06:58,850
established what we felt like was a good

167
00:07:04,180 --> 00:07:01,490
design criteria model for the lunar

168
00:07:05,830 --> 00:07:04,190
surface the actually the first the first

169
00:07:08,140 --> 00:07:05,840
mission was we actually

170
00:07:11,170 --> 00:07:08,150
impacted a ranger program on the moon

171
00:07:13,240 --> 00:07:11,180
and that was mainly to just see if we

172
00:07:15,430 --> 00:07:13,250
could actually do it first lunar impacts

173
00:07:17,710 --> 00:07:15,440
we had five or six missiles which didn't

174
00:07:19,690 --> 00:07:17,720
work too well we finally got one impact

175
00:07:21,510 --> 00:07:19,700
and we get the pictures coming in the

176
00:07:23,800 --> 00:07:21,520
moon but that didn't tell us too much

177
00:07:25,960 --> 00:07:23,810
but it did better my straighter we had

178
00:07:28,330 --> 00:07:25,970
the technology to drop something on the

179
00:07:30,370 --> 00:07:28,340
moon and then the idea became well now

180
00:07:32,379 --> 00:07:30,380
let's go back and see if we can go to

181
00:07:34,600 --> 00:07:32,389
some site that's really interesting on

182
00:07:37,210 --> 00:07:34,610
the moon and so that's why surveyor one

183
00:07:39,190 --> 00:07:37,220
site was picked mainly because there was

184
00:07:41,050 --> 00:07:39,200
nothing out there hardly an area and it

185
00:07:43,060 --> 00:07:41,060
was a very flat looking area based on an

186
00:07:45,159 --> 00:07:43,070
orbital analysis when first started out

187
00:07:47,650 --> 00:07:45,169
it was more important to be able to land

188
00:07:49,570 --> 00:07:47,660

on the surface and so but the surveyor

189
00:07:51,040 --> 00:07:49,580
spacecraft tail told us a lot about the

190
00:07:52,780 --> 00:07:51,050
moon's surface and we got some pretty

191
00:07:54,909 --> 00:07:52,790
good ideas of bearing strength and

192
00:07:56,710 --> 00:07:54,919
characteristics and we never did believe

193
00:07:58,690 --> 00:07:56,720
I never didn't believe the surface was

194
00:08:01,270 --> 00:07:58,700
going to be covered up in ten hundred

195
00:08:04,540 --> 00:08:01,280
meters of dust a lot of people did a lot

196
00:08:06,430 --> 00:08:04,550
of people had a concept but when the

197
00:08:08,350 --> 00:08:06,440
spacecraft bounced a couple of times we

198
00:08:10,680 --> 00:08:08,360
realized that well that at that

199
00:08:14,200 --> 00:08:10,690
particular site it I wrote a paper in

200
00:08:16,659 --> 00:08:14,210
1967 about going to a landed surveyor

201
00:08:18,700 --> 00:08:16,669
site to see if we could actually find

202
00:08:19,510 --> 00:08:18,710
piece of the material and bring them

203
00:08:22,960 --> 00:08:19,520
back to earth

204
00:08:26,529 --> 00:08:22,970
well that was severe one site but my

205
00:08:28,420 --> 00:08:26,539
idea finally evolved in Apollo 12 where

206
00:08:30,640 --> 00:08:28,430
they actually went to a surveyor site

207
00:08:33,279 --> 00:08:30,650
and actually brought back parts of the

208
00:08:38,009 --> 00:08:33,289
spacecraft and so I was really really

209
00:08:42,159 --> 00:08:40,300
it's sort of funny too while I was

210
00:08:44,829 --> 00:08:42,169
working on this programs trying to

211
00:08:46,180 --> 00:08:44,839
figure out dr. von Braun would come down

212
00:08:47,769 --> 00:08:46,190
every so often I had a lot of

213
00:08:50,230 --> 00:08:47,779

photographs and he would take a look at

214
00:08:52,050 --> 00:08:50,240
my photographs occasionally and we

215
00:08:53,740 --> 00:08:52,060
talked about where to go on the moon and

216
00:08:55,030 --> 00:08:53,750
that was well that was really

217
00:08:57,129 --> 00:08:55,040
interesting to meet the man and talk

218
00:08:58,960 --> 00:08:57,139
with him and so that was one thing

219
00:09:01,600 --> 00:08:58,970
already one of my memories already

220
00:09:03,610 --> 00:09:01,610
enjoyed von Braun was very much a people

221
00:09:05,800 --> 00:09:03,620
person most people don't realize that

222
00:09:08,290 --> 00:09:05,810
because been on earth Socrative been to

223
00:09:09,790 --> 00:09:08,300
German and Byron and stuff like that but

224
00:09:11,710 --> 00:09:09,800
he realized that if you're going to get

225
00:09:13,509 --> 00:09:11,720
people to work for him you got to let

226
00:09:16,629 --> 00:09:13,519
them think you're interested in he and

227
00:09:19,540 --> 00:09:16,639
you and so that's why was he might walk

228
00:09:21,730 --> 00:09:19,550
around in the lab and and and ask you

229
00:09:23,470 --> 00:09:21,740
what you're working on and a lot of

230
00:09:24,939 --> 00:09:23,480
times if you're working on some kind of

231
00:09:27,129 --> 00:09:24,949
engine part or something like that he

232
00:09:32,610 --> 00:09:27,139
may know that part and that was a funny

233
00:09:36,960 --> 00:09:34,410
there was a big decision between

234
00:09:39,570 --> 00:09:36,970
Marshall and Johnson who was going to

235
00:09:40,890 --> 00:09:39,580
control the program and NASA

236
00:09:42,690 --> 00:09:40,900
headquarters finally decided that

237
00:09:44,340 --> 00:09:42,700
Marshall would control the program so

238
00:09:48,120 --> 00:09:44,350

that part contract was issued in

239
00:09:50,010 --> 00:09:48,130
November 1969 for the boy and the one

240
00:09:52,290 --> 00:09:50,020
Boeing General Motors was selected as a

241
00:09:54,210 --> 00:09:52,300
contractor because their will design

242
00:09:56,160 --> 00:09:54,220
look like a better will design plus the

243
00:09:59,090 --> 00:09:56,170
fact they could actually fold the

244
00:10:01,320 --> 00:09:59,100
vehicle up and a lot of their studies

245
00:10:03,450 --> 00:10:01,330
earlier because they were thinking about

246
00:10:06,600 --> 00:10:03,460
building a severe spacecraft with a

247
00:10:09,210 --> 00:10:06,610
small remote control Rover on it for JPL

248
00:10:10,740 --> 00:10:09,220
and so but they didn't get the contract

249
00:10:13,110 --> 00:10:10,750
to build that but they had to concept

250
00:10:15,600 --> 00:10:13,120
them how to fold the thing up and this

251
00:10:17,460 --> 00:10:15,610
guy ference Pavlik from gentlemen for

252
00:10:21,180 --> 00:10:17,470
General Motors came in with his design

253
00:10:23,280 --> 00:10:21,190
and he had a little small radio control

254
00:10:25,830 --> 00:10:23,290
model of a rover what she'll actually be

255
00:10:27,570 --> 00:10:25,840
folded up and he put it on the floor and

256
00:10:29,940 --> 00:10:27,580
drove it into Vaughn Brown's office and

257
00:10:31,800 --> 00:10:29,950
I've been told that von Braun said you

258
00:10:33,540 --> 00:10:31,810
know we ought to go with you guys

259
00:10:35,430 --> 00:10:33,550
because your father hadn't anybody else

260
00:10:37,680 --> 00:10:35,440
but I don't know if that's true or not

261
00:10:39,840 --> 00:10:37,690
yeah we had all kind of signs we had

262
00:10:43,710 --> 00:10:39,850
with jumping designs we had crawling

263
00:10:44,820 --> 00:10:43,720

designs we had wheel designs that was

264
00:10:47,820 --> 00:10:44,830
that was something of the main those

265
00:10:49,680 --> 00:10:47,830
main concepts and I'm not way out but

266
00:10:51,870 --> 00:10:49,690
but the wheels seemed to be the way to

267
00:10:53,730 --> 00:10:51,880
go we did a lot of studies early Von

268
00:10:56,910 --> 00:10:53,740
Teese nails and those guys did a lot of

269
00:10:58,620 --> 00:10:56,920
studies on more emotional locomotions

270
00:11:00,390 --> 00:10:58,630
and braun engineering here did a lot of

271
00:11:02,100 --> 00:11:00,400
studies and the guys down in hayes

272
00:11:05,490 --> 00:11:02,110
aircraft did a lot of studies on the

273
00:11:07,410 --> 00:11:05,500
brown and finally we met Marshall got

274
00:11:09,300 --> 00:11:07,420
some money to contract out to get

275
00:11:11,370 --> 00:11:09,310
industry to see if he could come up with

276
00:11:14,070 --> 00:11:11,380
some nice designs and they came up with

277
00:11:16,830 --> 00:11:14,080
all kind of designs Grumman aircraft had

278
00:11:19,200 --> 00:11:16,840
a funny looking wheel design Bendix had

279
00:11:21,440 --> 00:11:19,210
another wheel design a Chrysler head

280
00:11:23,910 --> 00:11:21,450
almost like a track vehicle design

281
00:11:27,810 --> 00:11:23,920
ACDelco came up with their wheel design

282
00:11:31,050 --> 00:11:27,820
and it's ironic the wheel design comes

283
00:11:33,180 --> 00:11:31,060
from a guy in England in 1857 named

284
00:11:35,520 --> 00:11:33,190
Thomas rickets and he acts it was a guy

285
00:11:37,920 --> 00:11:35,530
that was building locomotive wheels and

286
00:11:40,170 --> 00:11:37,930
he wanted to build a small corridor some

287
00:11:42,480 --> 00:11:40,180
kind of small transporter and he came up

288
00:11:44,550 --> 00:11:42,490

with the idea of a metal elastic tire

289
00:11:46,079 --> 00:11:44,560
we bought the wheel design back to

290
00:11:48,720 --> 00:11:46,089
America and I say reinvented

291
00:11:50,999 --> 00:11:48,730
will because the problem was he didn't

292
00:11:52,650 --> 00:11:51,009
tell us how to make the tire and the

293
00:11:55,470 --> 00:11:52,660
tire looked like some kind of a wire

294
00:11:57,379 --> 00:11:55,480
mesh material so the engineers at

295
00:12:01,829 --> 00:11:57,389
General Motors our Sun they would have

296
00:12:05,670 --> 00:12:01,839
84 micron diameter wire size code it was

297
00:12:06,960 --> 00:12:05,680
tungsten tungsten coated wire and then

298
00:12:09,119 --> 00:12:06,970
we'd have to figure out how to make the

299
00:12:11,369 --> 00:12:09,129
mesh well we couldn't figure out to make

300
00:12:14,069 --> 00:12:11,379
the mesh but we found in General Motors

301
00:12:16,499 --> 00:12:14,079
actually found a basket weaver there and

302
00:12:18,720 --> 00:12:16,509
that basket we were axiom we both him a

303
00:12:20,790 --> 00:12:18,730
tray they built him a tray and he

304
00:12:23,249 --> 00:12:20,800
actually wove those towers takes about

305
00:12:25,290 --> 00:12:23,259
eight hours to make one tire and it was

306
00:12:26,850 --> 00:12:25,300
a very flexible time we had no problem

307
00:12:29,610 --> 00:12:26,860
with a target with the lunar astronauts

308
00:12:31,799 --> 00:12:29,620
actually drove about 56 miles on the

309
00:12:34,559 --> 00:12:31,809
moon if you take each of the mission

310
00:12:37,259 --> 00:12:34,569
nine the three different 15 16 and 17

311
00:12:39,509 --> 00:12:37,269
and each mission had three different

312
00:12:41,460 --> 00:12:39,519
driving missions in it you take all

313
00:12:43,470 --> 00:12:41,470

total of those nine different missions

314
00:12:45,509 --> 00:12:43,480
it's about 56 miles what I played a

315
00:12:47,369 --> 00:12:45,519
Birmingham and then we built a driving

316
00:12:49,259 --> 00:12:47,379
simulator here and we actually train the

317
00:12:51,150 --> 00:12:49,269
astronauts to drive on the moon and we

318
00:12:52,679 --> 00:12:51,160
cautioned them don't go above 10 miles

319
00:12:54,590 --> 00:12:52,689
an hour because if you do you'll be off

320
00:12:56,879 --> 00:12:54,600
the ground 35 percent of the time and

321
00:12:58,319 --> 00:12:56,889
what we almost lost a couple of time

322
00:12:59,999 --> 00:12:58,329
because they got a little too fast went

323
00:13:02,340 --> 00:13:00,009
to but it was epitopes part of it and

324
00:13:05,369 --> 00:13:02,350
that was one of my jobs also worked in

325
00:13:05,910 --> 00:13:05,379
the during the mission Apollo 15 16 and

326
00:13:08,249 --> 00:13:05,920
17

327
00:13:10,739 --> 00:13:08,259
we worked here in Huntsville and we

328
00:13:12,239 --> 00:13:10,749
actually had the guys to photograph

329
00:13:13,619 --> 00:13:12,249
where they were so we could actually

330
00:13:16,110 --> 00:13:13,629
determine whether they were on the moon

331
00:13:18,619 --> 00:13:16,120
surface general motors and AC Delco

332
00:13:22,079 --> 00:13:18,629
delivered three flight vehicles for us

333
00:13:23,489 --> 00:13:22,089
in 18 months actually liberal for flight

334
00:13:25,889 --> 00:13:23,499
vehicle but the fourth one was going to

335
00:13:27,269 --> 00:13:25,899
be a spare vehicle and they delivered

336
00:13:29,519 --> 00:13:27,279
and then they delivered eight different

337
00:13:34,880 --> 00:13:29,529
vehicles total four for fight and four

338
00:13:39,110 --> 00:13:37,070

well the big problem was how to select

339
00:13:40,730 --> 00:13:39,120
what kind of wheel design that was one

340
00:13:44,810 --> 00:13:40,740
of the big problem the second thing was

341
00:13:46,730 --> 00:13:44,820
how to provide the motor system and his

342
00:13:48,410 --> 00:13:46,740
drive system that was the second thing a

343
00:13:51,380 --> 00:13:48,420
big two of the biggest problems we had

344
00:13:53,060 --> 00:13:51,390
on it as far as the thermal control that

345
00:13:55,340 --> 00:13:53,070
was not we knew how can do that pretty

346
00:13:57,560 --> 00:13:55,350
well as far as radiation damage of a

347
00:13:59,420 --> 00:13:57,570
particle particular materials and an

348
00:14:02,030 --> 00:13:59,430
equipment we knew how to protect that

349
00:14:04,580 --> 00:14:02,040
pretty well the biggest thought biggest

350
00:14:06,650 --> 00:14:04,590
problem was the the inter reaction to

351
00:14:08,450 --> 00:14:06,660
soil in the wheel characteristics and

352
00:14:10,220 --> 00:14:08,460
like I say we did a lot of work in it

353
00:14:12,350 --> 00:14:10,230
waterways Experiment Station down in

354
00:14:14,090 --> 00:14:12,360
Mississippi so we had a pretty good idea

355
00:14:16,070 --> 00:14:14,100
of how well the vehicle could perform on

356
00:14:18,590 --> 00:14:16,080
the moon he gave us a lot of pride in

357
00:14:19,850 --> 00:14:18,600
doing something I mean here we are we're

358
00:14:20,450 --> 00:14:19,860
doing something nobody's ever done it

359
00:14:23,660 --> 00:14:20,460
before

360
00:14:25,460 --> 00:14:23,670
and it was sort of a national pride to

361
00:14:27,950 --> 00:14:25,470
be able to put those men on the moon and

362
00:14:29,330 --> 00:14:27,960
it's ironic when we put them in on the

363
00:14:31,360 --> 00:14:29,340

moon we really didn't plan to do

364
00:14:33,530 --> 00:14:31,370
anything but put them on the moon and

365
00:14:35,300 --> 00:14:33,540
but after a while they said you know

366
00:14:36,650 --> 00:14:35,310
well we're going to the moon why don't

367
00:14:40,010 --> 00:14:36,660
we do something when we get there

368
00:14:43,030 --> 00:14:40,020
you know but I still consider the Apollo

369
00:14:47,870 --> 00:14:43,040
program almost like Christopher Columbus

370
00:14:50,270 --> 00:14:47,880
but came over said America went home we

371
00:14:52,910 --> 00:14:50,280
came over went the moon didn't settle

372
00:14:54,680 --> 00:14:52,920
the moon and went home so I would love

373
00:14:57,260 --> 00:14:54,690
Cisco but I can settle the moon and do

374
00:14:59,660 --> 00:14:57,270
some research on the actual lunar

375
00:15:01,370 --> 00:14:59,670
history and that's and that's a real

376
00:15:02,720 --> 00:15:01,380
problem is we don't we don't know too

377
00:15:04,790 --> 00:15:02,730
much about the moon we don't even really

378
00:15:06,110 --> 00:15:04,800
know how the moon formed exactly there's

379
00:15:10,340 --> 00:15:06,120
a lot of theories on how the moon formed

380
00:15:14,000 --> 00:15:10,350
and we know we had a lot of volcanic

381
00:15:15,710 --> 00:15:14,010
activity on the moon so we need to go

382
00:15:18,500 --> 00:15:15,720
back and get go to some of the other

383
00:15:23,760 --> 00:15:18,510
sites and collect data from other sites

384
00:15:28,380 --> 00:15:26,010
but one of my most favorite members was

385
00:15:30,690 --> 00:15:28,390
was when I began working on the lunar

386
00:15:32,400 --> 00:15:30,700
surface operation stuff and and I was

387
00:15:34,890 --> 00:15:32,410
asked to participate in the Apollo 8

388
00:15:37,320 --> 00:15:34,900

launch as a member of the Scientific

389
00:15:38,910 --> 00:15:37,330
Advisory Committee on Apollo 8 and that

390
00:15:41,730 --> 00:15:38,920
was one of the biggest when I saw that

391
00:15:43,950 --> 00:15:41,740
and then and after that was I got to

392
00:15:45,450 --> 00:15:43,960
work on the early back in the old days I

393
00:15:46,950 --> 00:15:45,460
got to work on the early Jupiter flight

394
00:15:48,660 --> 00:15:46,960
test programs and that was sort of

395
00:15:50,970 --> 00:15:48,670
interesting being an Air Force officer

396
00:15:52,860 --> 00:15:50,980
myself I was sort of surprised when I

397
00:15:55,140 --> 00:15:52,870
found out the first Air Force ballistic

398
00:15:57,360 --> 00:15:55,150
missiles were the Jupiter missiles they

399
00:15:59,580 --> 00:15:57,370
were three squadrons here and Huntsville

400
00:16:01,020 --> 00:15:59,590
trained here in Huntsville I don't

401
00:16:02,880 --> 00:16:01,030
remember the numbers of squadron but

402
00:16:05,460 --> 00:16:02,890
they actually wound up in Italy and

403
00:16:06,870 --> 00:16:05,470
wound up in Turkey and there was

404
00:16:07,650 --> 00:16:06,880
something like I forget how many in

405
00:16:10,350 --> 00:16:07,660
Turkey

406
00:16:12,900 --> 00:16:10,360
Jupiter missile systems with Air Force

407
00:16:16,470 --> 00:16:12,910
insignias on them and they were nuclear

408
00:16:19,680 --> 00:16:16,480
warhead armed and aim for Moscow and

409
00:16:21,240 --> 00:16:19,690
that was 1961 well the service always

410
00:16:23,610 --> 00:16:21,250
had a good program as far as that goes

411
00:16:25,920 --> 00:16:23,620
they did they did land the first a Luna

412
00:16:28,350 --> 00:16:25,930
caught on the moon and that was the

413
00:16:30,060 --> 00:16:28,360

first electric car on the moon and they

414
00:16:32,850 --> 00:16:30,070
did but it didn't go very far on the

415
00:16:35,250 --> 00:16:32,860
moon but and they got a lot of good

416
00:16:37,080 --> 00:16:35,260
photography of the lunar surface but

417
00:16:38,760 --> 00:16:37,090
their photography was not what I call

418
00:16:39,870 --> 00:16:38,770
high resolution photography I don't

419
00:16:41,520 --> 00:16:39,880
think they released their high

420
00:16:44,100 --> 00:16:41,530
resolution photography that's the point

421
00:16:46,620 --> 00:16:44,110
and they did land a spacecraft on the

422
00:16:49,200 --> 00:16:46,630
moon first in that thing and they also

423
00:16:51,420 --> 00:16:49,210
did did the backside photographer the

424
00:16:53,940 --> 00:16:51,430
moon also high-resolution photography

425
00:16:56,700 --> 00:16:53,950
bike saw the moon and then they also

426
00:16:59,400 --> 00:16:56,710
brought a sample back from the moon to

427
00:17:01,800 --> 00:16:59,410
the earth which we did which we did

428
00:17:04,440 --> 00:17:01,810
which we have never done before but they

429
00:17:07,110 --> 00:17:04,450
did it yeah and then they tried to build

430
00:17:08,460 --> 00:17:07,120
their big booster and they blew up and

431
00:17:10,110 --> 00:17:08,470
killed a lot of people and I thought I

432
00:17:12,780 --> 00:17:10,120
killed that program for a while yeah

433
00:17:15,870 --> 00:17:12,790
well it was a space race in one sense a

434
00:17:17,940 --> 00:17:15,880
word because we didn't know who was

435
00:17:20,400 --> 00:17:17,950
going to control space and that was a

436
00:17:22,650 --> 00:17:20,410
point and then when the ballistic

437
00:17:25,829 --> 00:17:22,660
missiles came into phase that was a real

438
00:17:27,420 --> 00:17:25,839

problem what do we do now so we've got

439
00:17:29,070 --> 00:17:27,430
to build some kind of deterrent against

440
00:17:31,830 --> 00:17:29,080
that ballistic their ballistic missiles

441
00:17:33,910 --> 00:17:31,840
so that's really what happened in the

442
00:17:36,640 --> 00:17:33,920
early days of von Braun one

443
00:17:38,080 --> 00:17:36,650
to build a lunar base and that was culpa

444
00:17:40,720 --> 00:17:38,090
and he had a special program called

445
00:17:43,150 --> 00:17:40,730
project horizon and that was to build a

446
00:17:45,040 --> 00:17:43,160
lunar base on the moon and as the

447
00:17:46,780 --> 00:17:45,050
generals always said the mana control

448
00:17:49,450 --> 00:17:46,790
the high ground controls the battlefield

449
00:17:52,740 --> 00:17:49,460
so the moon or surface was the high

450
00:17:55,150 --> 00:17:52,750
ground but that base never got built and